DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
3701 NORTH FAIRFAX DRIVE
ARLINGTON, VA 22203-1714

Dear **BAA 07-17** Proposer Information Requester:

The BAA 07-17 Proposer Information Pamphlet is enclosed in response to your request. This pamphlet is divided into three sections.

SECTION I: Proposer Information provides further information on the Photonic Analog Signal-Processing Engines with Reconfigurability (PhASER) program, the submission, evaluation, and funding processes, proposal and proposal abstract formats, and other general information.

SECTION II: Broad Agency Announcement (BAA) 07-17, Photonic Analog Signal-Processing Engines with Reconfigurability (PhASER), is a reprint of the BAA which was posted on the Federal Business Opportunities (FedBizOpps) website at http://www.fedbizopps.gov/ and the Grants.gov website at http://www.grants.gov/.

SECTION III: Defense Advanced Research Projects Agency/Microsystems Technology Office (DARPA/MTO) provides information on current programs within MTO.

Thank you for your interest in BAA 07-17 **Photonic Analog Signal-Processing Engines with Reconfigurability (PhASER).**

Sincerely,

Michael Haney, Ph.D.
Program Manager
DARPA/MTO
3701 N. Fairfax Drive
Arlington, VA 22203-1714
Fax: (703) 696-2206
Email: Mike.Haney@darpa.mil

SECTION I: BAA 07-17 Proposer Information

This section provides further information on the Photonic Analog Signal-Processing Engines with Reconfigurability (PhASER) program, the submission, evaluation, and funding processes, proposal and proposal abstract formats, and other general information.

The Defense Advanced Research Projects Agency (DARPA) often selects its research efforts through the Broad Agency Announcement (BAA) process. The BAA will appear first on the FedBizOpps website, http://www.fedbizopps.gov/ and Grants.gov website at http://www.grants.gov/. Interested proposers must obtain Section 2 (Broad Agency Announcement) as it includes important information regarding this solicitation. Both documents together constitute the BAA. The following information is for those wishing to respond to the BAA.

DARPA is soliciting innovative research and development (R&D) proposals in the area of Photonic Analog Signal Processing Engines with Reconfigurability (PhASER). The overall goal is the creation of novel Photonic Integrated Circuit (PIC) elements, and associated programmable filter array concepts, that enable high-throughput, low-power signal processors which overcome the limits of conventional Silicon-based DSP technology. PhASER technology will be an enabler for anticipated future applications that have ultra-high throughput sensor signal processing requirements, but are highly constrained in size weight and power (SWaP). DARPA envisions that successful PhASER programs will establish PIC technology as a scalable platform for signal processing applications requiring greater than Tera-operations per second (TOPS) per Watt (W) of effective computing throughput. A key element of the new PhASER PIC technology will be programmability. Programmable PICs will enable, within one technology platform, circuits that are flexible and scalable enough to synthesis filters whose characteristics are specific to a variety of applications, and which may also be reconfigured at real-time rates for anticipated applications that require adaptive filter characteristics.

Proposed PhASER R&D should investigate innovative approaches that enable revolutionary advances in science, devices, circuits, and computing systems. Specifically excluded is R&D that primarily results in incremental or evolutionary improvements to the existing state of practice.

BACK GROUND AND DESCRIPTION

As PIC technology advances – with ever-increasing density and complexity of devices and circuits – DARPA is reexamining analog Optical Signal Processing (OSP) as a possible approach to realizing high-throughput filters for small-platform sensor processing applications. Of specific interest are high-bandwidth problems for which electronic analog-to-digital converters (ADCs) cannot achieve the desired dynamic range (DR), and where, therefore, performing the needed computations *in the analog domain* may prove

advantageous. Programmable PIC-based OSP architectures may enable reconfigurable time-domain analog filters that can be rapidly programmed for real-time applications – in a manner similar to digital electronic DSP technology, such as FPGAs and FIR filters, but with unprecedented high data throughput, reconfiguration speed, DR, and low SWaP.

DARPA envisions that the PhASER high-performance generalized analog photonic filtering architectures will emerge as integrated arrays of interconnected analog processing "Unit Cells," that perform programmable, ultra-high throughput (i.e., with single channel bandwidths exceeding 10 GHz), high DR (e.g., 60 dB), signal processing functions. PIC-enabled OSP, based on programmable arrays of Unit Cells, may achieve high computational throughput (e.g., greater than 10^{12} equivalent digital operations per second) and high DR filtering in the analog domain, while maintaining the flexibility, size, weight, and power of a typical single Silicon DSP integrated circuit chip.

DARPA is soliciting proposals for PIC concepts that are based on arrays of Unit Cells that perform reconfigurable time-domain filtering, based on emerging high-density photonic circuit technologies (e.g., Si, InP, hybrids), which will ultimately enable Photonic Analog Signal-Processing Engines with Reconfigurability (PhASER). Of particular interest to the PhASER program are architectures that perform finite impulse response (FIR) and infinite impulse response (IIR) filtering for sensor signals in the 10-200 GHz range, where high DR is needed, but high-resolution ADC technology does not exist. It is envisioned that high DR and low-power-consuming filtering operation can be achieved by remaining in the analog domain for the "high-bandwidth" elements of the needed filtering. By channelizing and filtering the ultra-high bandwidth signals, it is envisioned that PhASER circuits will exploit the inherent processing gain and efficiency of analog OSP and thereby provide a significant reduction in the sampling and throughput rates needed for succeeding steps. Therefore the PhASER concept may be viewed as a means to reducing information content while the signals are still in the analog domain, in order to, in succeeding steps, allow high-precision sampling at lower rates, with final processing carried out with conventional digital signal processing (DSP) techniques. The potential effective computational throughput of such filters on a PIC chip is projected to well-exceed one TOPS, where, for convenience, an operation is taken here to be an equivalent fixed point 8-bit multiply and accumulate (MAC) function. Such performance is beyond the projected capabilities of Silicon-based DSP technology.

It is envisioned that PhASER arrays may be configured in one, two, (or, possibly, even three) dimensional arrays of Unit Cells that are interconnected with a network of integrated waveguides. Active elements within the Unit Cells will be electronically adjustable to enable programmable and reconfigurable filters. Various Unit Cell configurations may be possible to realize FIR and IIR filters. For example, PhASER Unit Cells may be constructed with or without embedded optical gain elements and utilize resonant and/or path-length dependent delays to realize time domain filtering. Depending on the selected Unit Cell configuration, lattice and/or direct-form filter configurations may be achieved. In all potential architectures, it is essential that the PhASER PIC array be tightly integrated with low-power electronic control elements to exploit the high-density tunable Unit Cells, which enable programmable FIR/IIR filters of high-order for ultra-high bandwidth signals in a small volume package.

The PhASER program will focus on the development and experimental characterization of the Unit Cell of a PIC array, with performance goals that validate scalability to PIC-based implementation of filter circuits. Such PIC technology should be scalable to contain 256 Unit Cells per PIC and higher, and achieve ultimate chip yields of > 95%.

PROGRAM REQUIREMENTS

Challenge Problem:

To motivate, bound, and assist in the definition of the technical goals for the PhASER Unit Cells, the following "challenge problem" filter is provided. (Note: Although implementing the challenge problem filter is not a requirement for the PhASER program, it provides an important context within which to define and develop the PhASER Unit Cells and the time-domain processing array architecture within which the Unit Cells will function.) The envisioned ultimate PhASER filter should be able to perform FIR/IIR broadband filtering (with 10 GHz bandwidth and greater), have high dynamic range (a minimum of 60 dB SFDR at 10 GHz), and have high agility in filter reconfiguration (100 ns update time). The challenge filter for the ultimate PhASER PIC is: A 64-order filter which channelizes the signal to a programmable 50 MHz (3 dB) bandwidth window, with 60 dB isolation from the remainder of the 10 GHz band. Furthermore, the center frequency of the 50 MHz channel should be continuously tunable over the entire 10 GHz band. In addition, it must simultaneously perform a 32-point correlation on a signal within the channel. The filter must maintain the input 60 dB SFDR and consume less than 1 Watt of total power consumption – this includes the modulated laser source, filter control, and post detection electronic ADC function. In explaining how their PhASER concept would be used to implement the given challenge problem filter, proposers should discuss the details of the filter design trade-offs. This discussion should include typical filter fidelity measures, such as the slopes of the pass-band role off, pass-band and stop-band ripple, and sensitivity of filter response to variations in programmable (e.g., filter weights) and non-programmable (e.g., temperature, process non-uniformities) parameters. It is envisioned that the ultimate PhASER chip may contain as many as 10 such filters and achieve 95% yield of usable Unit Cells within the chip.

Unit Cell Description:

The primary focus of the PhASER program is on development and demonstration the Unit Cell. A successful proposal will therefore define a PhASER Unit Cell and demonstrate how, when arrayed in a high-density PIC chip and integrated with electronic control, it would enable the achievement of the PhASER filter challenge problem performance metrics stated above. It is the burden of the proposer to clearly explain how an array of Unit Cells can scale to meet the overall filter performance in terms of dynamic range, throughput, power consumption, and yield.

The Unit Cell may be defined as the minimum, or near-minimum, configuration of photonic devices which can be programmed to demonstrate a basic one-pole (e.g., band-pass) and one-zero (e.g., notch) filter performance; although not necessarily at the same time. In this

context, the Unit Cell nominally consists of a low-order array of active elements (e.g., a 2x2 arrays of connected programmable active elements) that are linked via integrated waveguides and the necessary splitter and coupler elements. The tunable active elements provide the reconfigurable filter weights that govern the location of the poles and zeros in the ultimate filter. The waveguide layout and topology define the fixed-delay, feed-forward, and feedback paths needed to realize high-order filters. Successful proposals must define and validate Unit Cell-level milestones by linking them to the filter-level metrics outlined in the challenge problem.

Reiterated, successful proposals will:

- Define a novel analog photonic "Unit Cell," which is nominally comprised of a sub-array of waveguide-connected programmable active elements. As an example, a Unit Cell might consist of a 2x2 array of active modulator and/or gain elements that are connected within a waveguide grid and have sufficient optical input and output ports to perform basic filtering operations on their own or be connected within a large array of Unit Cells to implement arbitrarily complex filters. The Unit Cell should be externally linkable with integrated waveguides, which allow it to function as a building block in programmable PIC arrays for generalized high-order FIR/IIR Filters;
- Develop a program plan that will permit the fabrication, testing, and evaluation of the Unit Cell;
- Describe how the Unit Cell, when arrayed within a high-density PIC, will scale and meet the PhASER filter challenge problem. Here, envisioned supporting tasks include developing a filter synthesis tool to demonstrate how Unit Cells will perform in the context of generalized high-order filters, and how they will be programmed and tested at the chip-level to ensure high yield. Linking the PhASER filter concept to real or projected military applications and requirements is encouraged in order to maximize the eventual performance benefits of the PhASER-based filtering architecture;
- Describe the technical approach that will be implemented in experimentally demonstrating the Unit Cell performance milestones;

.

Unit Cell Milestones:

Proposers must define their Unit Cell and describe in detail how the performance metrics of the Unit Cells will satisfy the requirements of the challenge problem. Though the performance parameters will depend on the particular architecture proposed, DARPA envisions some common performance metrics and some metrics specific to the proposed architecture. Common performance metrics include:

- Microwave operating Bandwidth: > 10 GHz;
- 2-tone SFDR: > 55 dB, with a stretch goal of 60 dB;
- Average Unit Cell power consumption < 25 mW;

- Unit cell yield of 95 %, where yield is defined as the number of Unit Cells on a wafer whose characteristics are those listed above, all within +/- 5%;
- Demonstration of Unit Cells with basic one-pole band-pass and a one-zero notch performance.

Metrics specific to the architecture proposed will naturally vary but should also be chosen as to satisfy the requirements of the challenge problem. As an example an architecture based on Unit Cells with SOAs may require optical gain element control range: - 50dB → +12dB, with continuously variable control over the range: -12dB → +12dB, with gain precision to +/- 0.5 dB.

High-order filter synthesis

High-order time-domain filters, as mentioned in the challenge problem, are those filters that exhibit multiple poles and zeros in the frequency response. For convenience here, we define the filter order for FIR filters to be the number of zeros, whereas for an IIR filter, the filter order is defined to be the sum of the number of poles and zeros. The challenge problem requires the ability to realize a programmable 64-order filter by concatenating arrays of proposed Unit Cells. To validate the Unit Cell's ability to be used as a building block for high-order filters, a filter synthesis tool must be developed within the PhASER program. This tool will be used to simulate high-order filter performance based on the Unit Cell characteristics. This tool will also be used to predict experiment performance of the single Unit Cell's performance in the PhASER program. With the above specified Unit Cell yield requirement of 95%, this simulation tool may also provide a means to validate the ability of the proposer's PhASER array concept to achieve arbitrary filters by configuring the array of Unit Cells in a manner which avoids "known bad" cells in order to ultimately achieve 95% yield at the chip level, as well as at the Unit Cell level. Filter chip yield may be estimated by statistical inferences based on the Unit Cell yield, filter reconfigurability, and redundancy arguments for the case of known-bad Unit Cells. The filter synthesis tool should be configured to facilitate the evaluation of projected performance of the PhASER filter for realistic military applications. In addition to validating basic projected filtering performance, the tool will be used, in part, to develop a transition plan (which will be part of a deliverable), whose purpose is to define a path toward eventual development of the PhASER technology for specific military applications.

Test and Evaluation

Validation of the Unit Cell milestones will be characterized experimentally with a modulated 10 GHz optical source and detector exhibiting greater than 60 dB SFDR. Unit Cell yield will be established by fabricating a sufficient number of Unit Cells to test and verify performance – where yield is defined as the number of Unit Cells on a wafer whose characteristics are those listed above, all within +/- 5%. Successful proposals will specify detailed testing methodologies for each Unit Cell milestone.

TECHNICAL AREAS OF INTEREST

For the PhASER Program, the Government requires an integrated experimental and theoretical approach which includes concept formulation and modeling, experimental verification, and device optimization. Proposed programs should include the following elements:

I. *Demonstration of photonic filtering technology:* PhASER will require innovative approaches to design and fabrication of reconfigurable Unit Cells that, when combined into a dense PIC array, will scale to meet the challenge problem performance metrics.

II. *Filter Algorithms:* Successful PhASER programs will require an understanding of the Unit Cell array scaling to high-order filters. A filter synthesis tool that simulates high-order filter algorithms based on the Unit Cell characteristics is required to verify a test and evaluation approach that can achieve 95% chip yield and predict performance for military sensor processing applications.

DELIVERABLES

The primary deliverables for the PhASER program are the final experimental demonstration of the Unit Cell concept, and a final technical report, which includes the transition plan. Programs with a proposed period-of-performance of one year or more should also include, as deliverables, an interim program review and report that would occur near the middle of the overall program.

PROGRAM SCOPE

The PhASER program will consist of a single phase whose focus is on the development and demonstration of the Unit Cell. Supporting tasks will include the development and demonstration of a filter synthesis software tool, and a related transition plan. Proposers must define a realistic schedule and budget to meet the milestone and deliverable schedule. It is recommended that the proposed program plan include interim milestones at approximately the halfway point of the program. Multiple awards are anticipated. Collaborative efforts/teaming including different expertise such as, but not limited to: photonic and electronic device design, fabrication, and packaging; filter design and integration; and military sensor processing system analysis are strongly encouraged. Cost sharing is not required and is not an evaluation criterion, but is encouraged where there is a reasonable probability of a potential commercial application related to the proposed research and development effort. Questions concerning this BAA may be directed to the technical POC for this effort, Dr. Michael Haney, phone: (571) 218-4813, fax: (703) 696-2206, electronic mail: Mike.Haney@darpa.mil.

SUBMISSION PROCESS

Proposers are **strongly encouraged** to submit a white paper in advance of a full proposal. This procedure is intended to minimize unnecessary effort in proposal preparation and review. The

time and date for submission of proposal abstracts is specified in the BAA. DARPA will acknowledge receipt of the submission and assign a control number that should be used in all further correspondence regarding the proposal abstract.

DARPA will respond to proposal abstracts with a recommendation to propose or not propose and the time and date for submission of a full proposal. DARPA will attempt to review proposal abstracts within thirty (30) calendar days after receipt and will allow proposers at least thirty (30) calendar days after review of their proposal abstracts in order to complete and submit their full proposals. Proposal abstracts will be reviewed as they are received. Early submissions of proposal abstracts and full proposals are strongly encouraged because selections may be made at any time during the evaluation process. Regardless of the recommendation, the decision to propose is the responsibility of the proposer. All submitted proposals will be fully reviewed regardless of the disposition of the proposal abstract. Proposers not submitting proposal abstracts are required to submit full proposals by the time and date specified in the BAA in order to be considered during the initial round of selections; however, proposals received after this deadline may be received and evaluated up to one year from the date of posting on FedBizOpps and Grants.gov. Full proposals submitted after the due date stated in the BAA or due date otherwise specified by DARPA after review of proposal abstracts may be selected contingent on the availability of funds.

The typical proposal should express a consolidated effort in support of both Areas of Interest (Demonstration of photonic filtering technology, Filter Algorithms) as specified above. Disjoint efforts should not be incorporated into a single proposal.

Restrictive notices notwithstanding, proposals may be handled, for administrative purposes only, by a support contractor. This support contractor is prohibited from competition in DARPA technical research and is bound by appropriate nondisclosure requirements. Proposals and proposal abstracts may not be submitted by fax or e-mail; any so sent will be disregarded.

Awards made under this BAA are subject to the provisions of the Federal Acquisition Regulation (FAR) Subpart 9.5, Organizational Conflict of Interest. All offerors and proposed subcontractors must affirmatively state whether they are providing scientific, engineering and technical assistance (SETA) or similar support to any DARPA technical office(s) through an active contract or subcontract. All affirmations must state which office(s) the offeror supports, and identify the prime contract number. Affirmations should be furnished at the time of proposal submission. All facts relevant to the existence or potential existence of organizational conflicts of interest, as that term is defined in the FAR 9.501, must be disclosed. The disclosure shall include a description of the action the offeror has taken, or proposes to take, to avoid, neutralize or mitigate such conflict.

Proposals selected for funding are required to comply with provisions of the Common Rule (32 CFR 219) on the protection of human subjects in research (http://www.dtic.mil/biosys/downloads/32cfr219.pdf) and the Department of Defense Directive 3216.2 (http://www.dtic.mil/whs/directives/corres/html2/d32162x.htm). All proposals that involve the use of human subjects are required to include documentation of their ability to follow Federal guidelines for the protection of human subjects. This includes, but is not limited to,

protocol approval mechanisms, approved Institutional Review Boards (IRBs), and Federal Wide Assurances. These requirements are based on expected human use issues sometime during the entire length of the proposed effort. For proposals involving "greater than minimal risk" to human subjects within the first year of the project, performers must provide evidence of protocol submission to a federally approved IRB *at the time of final proposal submission to DARPA.* For proposals that are forecasted to involve "greater than minimal risk" after the first year, a discussion on how and when the proposer will comply with submission to a federally approved IRB needs to be provided in the submission. More information on applicable federal regulations can be found at the Department of Health and Human Services – Office of Human Research Protections website (http://www.dhhs.gov/ohrp/).

EVALUATION CRITERIA/EVALUATION AND FUNDING PROCESSES

Proposals will not be evaluated against each other since they are not submitted in accordance with a common work statement. DARPA's intent is to review proposals as soon as possible after they arrive; however, proposals may be reviewed periodically for administrative reasons.

For evaluation purposes, a proposal is the two-volume document described in PROPOSAL FORMAT (see below). Other supporting or background materials submitted with the proposal will be considered for the reviewer's convenience only and not considered part of the proposal.

PROPOSAL EVALUATION

The criteria to be used to evaluate and select proposals for this project are described in the following paragraphs. The criteria to be used to evaluate and select offers under this BAA are, in order of descending importance: (a) Overall Scientific and Technical Merit; (b) Proposer's Capabilities and/or Related Experience; (c) Realism of Proposed Schedule. (d) Potential Contribution and Relevance to the DARPA Mission; (e) Plans and Capability to Accomplish Technology Transition; and (f) Cost Reasonableness and Realism; each proposal will be evaluated on its own merit and relevance rather than against other proposals in the same general area, since no common work statement exists. Proposals may be evaluated as they are received, or they may be collected and periodically reviewed. The following are descriptions of the above listed criteria:

OVERALL SCIENTIFIC AND TECHNICAL MERIT

The proposed technical approach is feasible, achievable, complete and supported by a proposed technical team that has the expertise and experience to accomplish the proposed tasks. Task descriptions and associated technical elements provided are complete and in a logical sequence with all proposed deliverables clearly defined such that a final product that achieves the goal can be expected as a result of award. The proposal identifies major technical risks and planned mitigation efforts are clearly defined and feasible.

PROPOSER'S CAPABILITIES AND/OR RELATED EXPERIENCE

The proposer's prior experience in similar efforts must clearly demonstrate an ability to deliver products that meet the proposed technical performance within the proposed budget and schedule. The proposed team has the expertise to manage the cost and schedule. Similar efforts completed/ongoing by the proposer in this area are fully described including identification of other Government sponsors.

REALISM OF PROPOSED SCHEDULE

The proposer's abilities to aggressively pursue performance metrics in the shortest timeframe and to accurately account for that timeframe will be evaluated.

POTENTIAL CONTRIBUTION AND RELEVANCE TO THE DARPA MISSION

The potential contributions of the proposed effort with relevance to the national technology base will be evaluated. Specifically, DARPA's mission is to maintain the technological superiority of the U.S. military and prevent technological surprise from harming our national security by sponsoring revolutionary, high-payoff research that bridges the gap between fundamental discoveries and their military use.

PLANS AND CAPABILITY TO ACCOMPLISH TECHNOLOGY TRANSITION

The capability to transition the technology to research, industrial, and operational military communities in such a way as to enhance U.S. defense, to include the extent to which IP being delivered with less than unlimited rights, if any, creates a barrier to technology transition.

COST REASONABLENESS AND REALISM

The objective of this criterion is to establish that the proposed costs are reasonable and realistic for the technical and management approach offered, as well as to determine the proposer's practical understanding of the effort. This will be principally measured by cost per labor-hour and number of labor-hours proposed. The evaluation criterion recognize that undue emphasis on cost may motivate proposers to offer low-risk ideas with minimum uncertainty and to staff the effort with junior personnel in order to be in a more competitive posture. DARPA discourages such cost strategies. Cost reduction approaches that will be received favorably include innovative management concepts that maximize direct funding for technology and limit diversion of funds into overhead.

Award(s) will be made to proposers whose proposals are determined to be the most advantageous to the Government, all factors considered, including the potential contributions of the proposed work to the overall research program and the availability of funding for the effort. Award(s) may be made to any proposer(s) whose proposal(s) is determined selectable regardless of its overall rating.

NOTE: PROPOSERS ARE CAUTIONED THAT EVALUATION SCORES MAY BE LOWERED AND/OR PROPOSALS REJECTED IF SUBMITTAL INSTRUCTIONS ARE NOT FOLLOWED.

As soon as the proposal evaluation is completed, the proposer will be notified of selectability or non-selectability. Selectable proposals will be considered for funding; non-selectable proposals will be destroyed. (One copy of non-selectable proposals may be retained for file purposes.) The Government reserves the right to select for award all, some, or none of the proposals received and to make awards without discussions. In the event that DARPA desires to award only portions of a proposal, negotiations will be opened with that proposer. All responsible sources capable of satisfying the Government's needs may submit a proposal which shall be considered by DARPA.

Proposals identified for funding may result in a procurement contract, grant, cooperative agreement, or other transaction depending upon the nature of the work proposed, the required degree of interaction between parties, and other factors. If warranted, portions of resulting awards may be segregated into pre-priced options.

The cost of preparing proposals in response to this announcement is not considered an allowable direct charge to any resulting contract or any other contract. Proposers are warned that only Contracting Officers are legally authorized to commit the Government.

TEAMING ARRANGEMENTS

Teaming is strongly encouraged and teaming arrangements should be explained clearly in the proposal abstracts and full proposals. Integrated teams capable of addressing different technological and scientific aspects of the PhASER program will be highly valued. Teams composed of partners from academia, industry, and national laboratories are encouraged. While innovative proposals from small groups will be considered, a website (http://www.davincinetbook.com/teams) will be established to facilitate teaming between interested parties. Specific information content, communications, networking, and team formation are the sole responsibilities of the participants. Neither DARPA nor the Department of Defense (DoD) endorses the destination website or the information and organizations contained therein, nor does DARPA or the DoD exercise any responsibility at the destination. This website is provided consistent with the stated purpose of this BAA.

PROPOSER'S QUESTIONS

A "Proposer's Questions," website will be posted for BAA 07-17 on the DARPA, Microsystems Technology Office solicitations page (www.darpa.mil/baa/#eto). If you would like to have a question answered and posted on this site, please send your question to the following address: BAA07-17@darpa.mil.

FORMAT AND SUBMITTAL

The form and format for abstracts and proposals follows below. Abstracts and proposals that do not satisfy these form and format requirements may be rejected without further review or evaluation. All submissions should be in the English language. Abstracts should be submitted electronically; a paper copy is not required. Proposals should also be submitted electronically accompanied by a transmittal letter signed by an official who is authorized to commit the offeror.

Electronic copies should be in Microsoft Word format or PDF and submitted via a web site interface: Web Site: https://www.tfims.darpa.mil/baa. University (prime) grant submissions may be made via the Grants.gov web site, http://www.grants.gov/, by using the "Apply" function. Please note, proposal submissions are only required through one web site. Proposals received by MTO but not submitted specifically to the BAA may be considered under the BAA.

PROPOSAL ABSTRACT FORMAT

The submission of an abstract is optional, but strongly recommended. An abstract should be a brief summary. It introduces the idea, solicits interaction with MTO, and avoids the expense of generating proposals that have little likelihood of selection within this BAA. Abstracts should summarize the planned proposal and clearly articulate the innovative concept or technology development being proposed.

Proposal abstracts should follow the same general structure described for Volume I under PROPOSAL FORMAT (see below), but are expected to provide a concise summary rather than extensive detail. The maximum page lengths for each section shown in braces { } below can be neglected; however, **the total length excluding the cover sheet shall not exceed ten (10) pages.** The cover sheet should be clearly marked "PROPOSAL ABSTRACT." All pages shall be printable on 8-1/2 by 11 inch paper with type not smaller than 12 point. The page limitation for proposal abstracts includes all figures, tables, and charts. No formal transmittal letter is required. Receipt will be confirmed. Abstracts should avoid proprietary or classified information or data not critical to the idea being presented**.**

PROPOSAL FORMAT

All full proposals must be in the following format. Nonconforming proposals may be rejected without review. Proposals shall consist of two volumes. All pages shall be printable on 8-1/2 by 11 inch paper with type not smaller than 12 point. The page limitation for full proposals includes all figures, tables, and charts. Volume I, Technical and Management Proposal, may include an attached bibliography of relevant technical papers or research notes (published and unpublished) which document the technical ideas and approach upon which the proposal is based. Copies of not more than six (6) relevant papers can be included with the submission. The bibliography and attached papers are not included in the page counts given below. The submission of other supporting materials along with the proposal is strongly discouraged and will not be considered for review. Except for the attached bibliography, Volume I shall not exceed forty (40) pages**,** not including Section IV. Maximum page lengths for each section are shown in braces { } below.

Volume I, Technical and Management Proposal

Section I. Administrative

A. {1} **Cover sheet.** This should include: (1) BAA number; (2) Technical area; (3) Lead Organization Submitting proposal; (4) Type of business, selected among the following categories: "LARGE BUSINESS", "SMALL DISADVANTAGED BUSINESS", "OTHER SMALL BUSINESS", "HBCU", "MI", "OTHER EDUCATIONAL", or "OTHER NONPROFIT"; (5) Contractor's reference number (if any); (6) Other team members (if applicable) and type of business for each; (7) Proposal title; (8) Technical point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available); (9) Administrative point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available), total funds requested from DARPA, and the amount of cost-share (if any); and (10) Date proposal was prepared.

B. {1} **Official transmittal letter**.

Table of Contents:

Section II. Executive Summary

{3} This should clearly and concisely summarize the following:

- Innovative claims for the proposed programs that include a description of the unique technical solutions and approaches being proposed.
- The quantitative end-of-program performance goals and the key milestones associated with the development effort.
- An explanation of how the goals compare to what has already been demonstrated.

Section III. Detailed Proposal Information

A. {15} **Technical Rationale & Approach**. A concise section outlining the scientific and technical challenges, unique approaches, and potential anticipated technical solutions to the challenges that will be addressed. This statement should demonstrate that the proposer has a clear understanding of the state-of-the-art; and should provide sufficient technical details so as to permit complete evaluation of the feasibility of the idea.

B. {7 + 1 for table} **Program Plan & Risk Assessment.** A narrative explaining the explicit timelines, milestone achievements, and quantitative metrics by which progress toward the goals can be evaluated. This plan should include a specific and detailed test plan detailing how performance of milestones will be measured. The proposed period of performance of the overall program should be clearly stated. Milestones must be associated with demonstrable, quantitative measures of performance, and should be summarized in a single table. **Measurable milestones should occur every six months after start of effort.** This section should also identify major technical risk elements specific to the proposed approach, estimate the risk magnitude for each such element, and describe specific plans to mitigate risk. Proposers shall clearly define all deliverables associated with the proposed research; all proprietary assertions to intellectual property of

all types, including any background inventions, shall be set forth in detail. (See Volume 2, Section D, Intellectual Property.)

C. {3} **Teaming & Management Plan.** A management plan that describes how the different members of the team will collaborate to demonstrate viable solutions to the program challenges.

D. {5} **Capabilities.** A section describing relevant prior work, the background, qualifications and relevant experience of key individuals to be assigned to the program and the facilities and equipment to be utilized. Please do not attach supporting material (CDs, movies, etc.) to the proposal, except as noted in Section IV below.

E. {5} **Slide Summary.** PowerPoint-type slides (i.e., landscape formatted for presentation) that succinctly highlight the major aspects of the proposal in a manner suitable for presentation to DARPA management.

Section IV. Additional Information {Optional}

A. A brief bibliography of relevant technical papers and research notes (published and unpublished) which document the technical ideas upon which the proposal is based may be provided. Copies of not more than six (6) relevant papers can be included in the submission. This section does not count towards the overall page limit for Volume I.

Volume II, Cost Proposal – {No page limit}

A. Cover sheet to include: (1) BAA number; (2) Technical area; (3) Lead Organization Submitting proposal; (4) Type of business, selected among the following categories: "LARGE BUSINESS", "SMALL DISADVANTAGED BUSINESS", "OTHER SMALL BUSINESS", "HBCU", "MI", "OTHER EDUCATIONAL", or "OTHER NONPROFIT"; (5) Contractor's reference number (if any); (6) Other team members (if applicable) and type of business for each; (7) Proposal title; (8) Technical point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), electronic mail (if available); (9) Administrative point of contact to include: salutation, last name, first name, street address, city, state, zip code, telephone, fax (if available), and electronic mail (if available); (10) Award instrument requested: cost-plus-fixed-fee (CPFF), cost-contract--no fee, cost sharing contract--no fee, or other type of procurement contract (specify), grant, cooperative agreement, or other transaction; (11) Place(s) and period(s) of performance; (12) Total proposed cost separated by basic award and option(s) (if any); (13) Name, address, and telephone number of the offeror's cognizant Defense Contract Management Agency (DCMA) administration office (if known); (14) Name, address, and telephone number of the offeror's cognizant Defense Contract Audit Agency (DCAA) audit office (if known); (15) Date proposal was prepared; (16) the offeror's Contractor and Government Entity (CAGE) Code, Dun and Bradstreet (DUN) Number, North American Industrial Classification System (NAICS) Number, and Tax Identification Number (TIN); (17) Proposal expiration date.

B. Detailed cost breakdown to include: (1) total program cost broken down by major cost items (direct labor, indirect rates/factors, subcontracts and/or consultants, materials

and/or equipment, travel/other direct costs, etc.) and further broken down by year; (2) major program tasks by year; (3) an itemization of major subcontracts* and material and/or equipment purchases; (4) an itemization of any information technology (IT)* purchases; (5) a summary of projected funding requirements by month; and (6) the source, nature, and amount of any industry cost-sharing. Where the effort consists of multiple portions which could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each.

*To include similar cost breakdown as required by the offeror (prime).

C. Supporting cost and pricing information, to include subcontractor proposals and associated backup documentation, in sufficient detail to substantiate the summary cost estimates in B. above. Include a description of the method used to estimate costs and supporting documentation. Note: "cost or pricing data" as defined in FAR Subpart 15.4 shall be required if the offeror is seeking a procurement contract award of $650,000 or greater unless the offeror requests an exception from the requirement to submit cost or pricing data. "Cost or pricing data" are not required if the offeror proposes an award instrument other than a procurement contract (e.g., a grant, cooperative agreement, or other transaction). Please also provide any Forward Pricing Rate Agreement, other such Approved Rate Information, or such other documentation that may assist in expediting negotiations (if not available, state so).

INTELLECTUAL PROPERTY

The government will assess items of intellectual property that are proposed to be delivered with less than Unlimited Rights as part of the "Overall scientific and technical merit" evaluation criterion.

- IT is defined as "any equipment, or interconnected system(s) or subsystem(s) of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the agency. (a) For purposes of this definition, equipment is used by an agency if the equipment is used by the agency directly or is used by a contractor under a contract with the agency which – (1) Requires the use of such equipment; or (2) Requires the use, to a significant extent, of such equipment in the performance of a service or the furnishing of a product. (b) The term "information technology" includes computers, ancillary, software, firmware and similar procedures, services (including support services), and related resources. (c) The term "information technology" does not include – (1) Any equipment that is acquired by a contractor incidental to a contract; or (2) Any equipment that contains imbedded information technology that is used as an integral part of the product, but the principal function of which is not the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information. For example, HVAC (heating, ventilation, and air conditioning) equipment such as thermostats or temperature control devices, and medical equipment where information technology is integral to its operation, are not information technology."

1. Procurement Contract Proposers

a. Noncommercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS, shall identify all noncommercial technical data, and noncommercial computer software that it plans to generate, develop, and/or deliver under any proposed award instrument in which the Government will acquire less than unlimited rights, and to assert specific restrictions on those deliverables. Proposers shall follow the format under DFARS 252.227-7017 for this stated purpose. In the event that proposers do not submit the list, the Government will assume that it automatically has "unlimited rights" to all noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, unless it is substantiated that development of the noncommercial technical data and noncommercial computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data, and noncommercial computer software generated, developed, and/or delivered under any award instrument, then proposers should identify the data and software in question, as subject to Government Purpose Rights (GPR). In accordance with DFARS 252.227-7013 Rights in Technical Data - Noncommercial Items, and DFARS 252.227-7014 Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation, the Government will automatically assume that any such GPR restriction is limited to a period of five (5) years in accordance with the applicable DFARS clauses, at which time the Government will acquire "unlimited rights" unless the parties agree otherwise. Proposers are admonished that the Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are intended, then the proposer should state "NONE."

A sample list for complying with this request is as follows:

NONCOMMERCIAL			
Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

b. Commercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS, shall identify all commercial technical data, and commercial computer software that may be embedded in any noncommercial deliverables contemplated under the research effort, along with any applicable restrictions on the Government's use of such commercial technical data and/or commercial computer software. In the event that proposers do not submit the list, the Government will assume that there are no restrictions

on the Government's use of such commercial items. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are intended, then the proposer should state "NONE."

A sample list for complying with this request is as follows:

COMMERCIAL			
Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

2. NonProcurement Contract Proposers - Noncommercial and Commercial Items (Technical Data and Computer Software)

   Proposers responding to this BAA requesting a Grant, Cooperative Agreement, Technology Investment Agreement, or Other Transaction for Prototype shall follow the applicable rules and regulations governing these various award instruments, but in all cases should appropriately identify any potential restrictions on the Governments use of any Intellectual Property contemplated under those award instruments in question. This includes both Noncommercial Items and Commercial Items. Although not required, proposers may use a format similar to that described in Paragraphs 1.a and 1.b above. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer's assertions. If no restrictions are intended, then the proposer should state "NONE."

3. All Proposers – Patents

   Please include documentation proving your ownership of or possession of appropriate licensing rights to all patented inventions (or inventions for which a patent application has been filed) that will be utilized under your proposal for the DARPA program. If a patent application has been filed for an invention that your proposal utilizes, but the application has not yet been made publicly available and contains proprietary information, you may provide only the patent number, inventor name(s), assignee names (if any), filing date, filing date of any related provisional application, and a summary of the patent title, together with either: 1) a representation that you own the invention, or 2) proof of possession of appropriate licensing rights in the invention.

4. All Proposers-Intellectual Property Representations

Please provide a good faith representation that you either own or possess appropriate licensing rights to all other intellectual property that will be utilized under your proposal for the DARPA program.

GUIDANCE FOR CLASSIFIED INFORMATION AND DATA

The Government anticipates that proposals submitted under a BAA will be unclassified. In the event that a proposer chooses to submit a classified proposal or submit any documentation that may be classified, the following information is applicable.

Security Classification guidance on DD Form 254 will not be provided at this time since DARPA is soliciting ideas only. After reviewing the incoming proposals, if a determination is made that the award instrument may result in access to classified information, a DD Form 254 will be issued and attached as part of the award. Proposers choosing to submit a classified proposal must first receive permission from the Original Classification Authority to use their information in applying to this BAA. An applicable classification guide should be submitted to ensure that the proposal is protected appropriately.

Classified submissions shall be in accordance with the following guidance:

Collateral Classified Data: Use classification and marking guidance provided by previously issued security classification guides, the Information Security Regulation (DoD 5200.1-R), and the National Industrial Security Program Operating Manual (DoD 5220.22-M) when marking and transmitting information previously classified by another original classification authority. Classified information at the Confidential and Secret level may only be mailed via U.S. Postal Service (USPS) Registered Mail or U.S. Postal Service Express Mail (USPS only; not DHL, UPS or FedEx). All classified information will be enclosed in opaque inner and outer covers and double wrapped. The inner envelope shall be sealed and plainly marked with the assigned classification and addresses of both sender and addressee. The inner envelope shall be addressed to:

Defense Advanced Research Projects Agency (DARPA)
ATTN: BAA 07-17, DARPA/MTO, Dr. Michael Haney
3701 North Fairfax Drive, Suite 518
Arlington, VA 22203-1714

The outer envelope shall be sealed with no identification as to the classification of its contents and addressed to:

Defense Advanced Research Projects Agency (DARPA)
Security & Intelligence Directorate, Attn: CDR
3701 North Fairfax Drive, Suite 832
Arlington, VA 22203-1714

All Top Secret materials should be hand carried via an authorized, two-person courier team to the DARPA Classified Document Registry (CDR).

Special Access Program (SAP) Information: Contact the DARPA Program Security Support Center (PSSC) at 703-812-1962/1970 for further guidance and instructions prior to transmitting to DARPA. All Top Secret SAP, must be transmitted via approved methods for such material. Consult the DoD Overprint to the National Industrial Security Program Operating Manual for further guidance. It is strongly recommended that you coordinate the transmission of SAP material and information with the DARPA PSSC prior to transmission.

Sensitive Compartmented Information (SCI) Data: Contact the DARPA Special Security Contact Office (SSCO) at 703-812-1993/1994 for the correct SCI courier address and instructions. All SCI should be transmitted through your servicing Special Security Officer (SSO) / Special Security Contact Officer (SSCO). All SCI data must be transmitted through your servicing Special Security Officer (SSO) / Special Security Contact Officer (SSCO). All SCI data must be transmitted through SCI channels only (i.e., approved SCI Facility to SCI facility via secure fax).

Proprietary Data: All proposals containing proprietary data should have the cover page and each page containing proprietary data clearly marked as containing proprietary data. It is the proposer's responsibility to clearly define to the Government what is considered proprietary in nature.

Proposers must have existing and in-place prior to execution of an award, approved capabilities (personnel and facilities) to perform research and development at the classification level they propose.

SUBMISSION INFORMATION

DARPA/MTO will employ an electronic upload process, the Technical Financial Information Management System (T-FIMS) Proposal Submission System, for all proposal submissions to this BAA. All material submitted through T-FIMS must be UNCLASSIFIED. Please DO NOT attempt to submit a CLASSIFIED material proposal through the electronic upload process as this is PROHIBITED. Offerors that intend to include classified, or potentially classified, information or data as part of their proposals shall submit an UNCLASSIFIED PROPOSAL referring to a classified annex. The offeror should contact the Technical POC for this BAA, or the Security POC cited above, for guidance on submitting the classified annex. Content of proposal submissions made through T-FIMS must be UNCLASSIFIED.

Organizations must register at: http://www.tfims.darpa.mil/baa to submit a proposal. Only the lead or prime organization should register. One registration per proposal should be submitted. Organizations wishing to submit multiple proposals should complete a single registration for each proposal. The deadline for registration for the electronic submissions of abstracts is 01 February 2007 and the deadline for registration for electronic submissions of proposals is 28 March 2007 at the registration Uniform Resource Locator (URL) listed above. By registering, the Proposer has made no commitment to submit.

The T-FIMS Proposal Submission System can support the following file formats: Portable Document Format (pdf), Word Document (doc), Plain Text (txt), Comma-separated Values (csv), PowerPoint Presentation (ppt), Excel Worksheet (xls), and Excel Workspace (xlw). PDF is the preferred format. Proposal submissions made through the T-FIMS Proposal Submission System must be no larger than 50 megabytes per file. This means that the Technical Volume file, as well as the Cost Volume file, must not exceed 50 megabytes, individually, as the T-FIMS program will not allow it. This announcement and any additional supporting materials may be retrieved via the WWW at URL http://www.darpa.mil/ in the solicitations area.

University (prime) grant submissions may be made via the Grants.gov web site, http://www.grants.gov/, by using the "Apply" function.

AWARD ADMINISTRATION INFORMATION

(1) Central Contractor Registration. Selected proposers not already registered in the Central Contractor Registry (CCR) will be required to register in CCR prior to any award under this BAA. Information on CCR registration is available at http://www.ccr.gov.

(2) Representations and Certifications. In accordance with Federal Acquisition Regulation 4.1201, prospective proposers shall complete electronic annual representations and certifications at http://orca.bpn.gov.

PUBLIC RELEASE OR DISSEMINATION OF INFORMATION

The following provision will be incorporated into any resultant contract:

(a) There shall be no dissemination or publication, except within and between the Contractor and any subcontractors, of information developed under this contract or contained in the reports to be furnished pursuant to this contract without prior written approval of the Contracting Officer Representative (COR). All technical reports will be given proper review by appropriate authority to determine which Distribution Statement is to be applied prior to the initial distribution of these reports by the Contractor. Papers resulting from unclassified contracted fundamental research are exempt from prepublication controls and this review requirement, pursuant to DoD Instruction 5230.27 dated October 6, 1987.

(b) When submitting material for clearance for open publication, the Contractor must furnish DARPA Technical Information Officer, 3701 North Fairfax Drive, Arlington VA 22203-1714, telephone (703) 526-4163 with five copies and allow four weeks for processing. Viewgraph presentations must be accompanied with a written text. Whenever a paper is to be presented at a meeting, the Contractor must indicate the exact dates of the meeting or the Contractor's date deadline for submitting the material.

EXPORT LICENSES

The following provision will be incorporated into any resultant contract:

Should this project develop beyond fundamental research (basic and applied research ordinarily published and shared broadly within the scientific community) with military or dual-use applications the following apply:

(1) The contractor shall comply with all U. S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, in the performance of this contract. In the absence of available license exemptions/exceptions, the Contractor shall be responsible for obtaining the appropriate licenses or other approvals, for obtaining the appropriate licenses or other approvals, if required, for exports of hardware, technical data, and software, or for the provision of technical assistance.

(2) The Contractor shall be responsible for obtaining export licenses, if required, before utilizing foreign persons in the performance of this contract, including instances where the work is to be performed on-site at any Government installation, where the foreign person will have access to export-controlled technical data or software.

(3) The Contractor shall be responsible for all regulatory record keeping requirements associated with the use of licenses and license exemptions/exceptions.

(4) The Contractor shall be responsible for ensuring that the provisions of this clause apply to its subcontractors.

SUBCONTRACTING

Pursuant to Section 8(d) of the Small Business Act (15 U.S.C. 637(d)), it is the policy of the Government to enable small business and small disadvantaged business concerns to be considered fairly as subcontractors to contractors performing work or rendering services as prime contractors or subcontractors under Government contracts, and to assure that prime contractors and subcontractors carry out this policy. Each proposer who submits a contract proposal and includes subcontractors is required to submit a subcontracting plan IAW FAR 19.702(a) (1) and (2) should do so with their proposal. The plan format is outlined in FAR 19.704.

CONFIDENTIALITY

It is the policy of DARPA to treat all proposals as competitive information and to disclose their contents only for the purpose of evaluation. No proposals will be returned. The original of each proposal received will be retained at DARPA and all other copies of non-selected proposals destroyed. Documentation related to the source selection process will be marked SOURCE SELECTION INFORMATION – SEE FAR 2.101 AND 3.104.